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ABSTRACT

This paper explores the concept of sustainable Information Systems through the comparison of two approaches to systems development. Information Systems are predominantly developed from a project perspective. This project-based approach would tend to view the output (in this case the Information System) as an asset to the organization and involve some variations around a structured process of development. Information Systems development can also be a collection of different computer systems being brought together within an organization for a specific purpose. In this sense the Information System can be viewed as individual consumables that have been brought together. These consumables are then introduced and adapted as and when needed by the organization for its specific needs. The paper argues that an organization's view of its Information Systems network would have an impact on how new Systems would be implemented and used within it. Should Information Systems be viewed as assets or as some consumables?

This paper explores the problems and opportunities that the notion of Information Systems as consumables provides.

Keywords

Information Systems Sustainability, Requirements, Living Systems, Urban Traffic Management and Control (UTMC), Common Standards, IS Development Approaches.

INTRODUCTION

One of the reasons given for the adoption of Information Systems is to support the business objectives of the Organization (Kanellis, Lycett and Paul 1999). It can be argued that Organizations could receive a higher return on their investment in Information Systems and the technology they are based on if the overall approach to the Information Systems adoption leads to a Sustainable System. This is one of the purposes of this particular research. How can we pave a path towards designing, developing and implementing Sustainable Information Systems?

In order to demonstrate our approach this paper looks at a case study in the field of traffic management and control in the United Kingdom. A set of standards for traffic management systems known as the UTMC initiative has been defined. These standards propose the use of Intelligent Transport Systems in traffic management. The case study looks at how this standard is being implemented in one of the Local Authorities in the South East of England. Rather than viewing this new initiative from a project-based approach, the Local Authority has taken a more dynamic view of this Information Systems development incorporating legacy computer systems into a wider Information System. The UTMC standard calls for open systems with common interfaces to enable systems to plug into each other irrespective of differences in systems suppliers.

For the purposes of this paper our focus for Sustainable Information Systems is on the operational effectiveness in the long term and maintainability of any Organizational Information System that would continue to meet the needs of the Organization. In other words the focus is on longevity.

TWO APPROACHES

Since the "software crisis" of the early 1960's systems development has been more structured (Lycett, Macredie, Paul and Patel 2003). Such structures are often referred to as development methods or methodologies. Avison and Fitzgerald (2003)

refer to this period up to the 1990s as the methodology era in which several problems have arisen and been addressed. Still, there is no agreement on the most practical System Development techniques and methods for the design and take up of Information Systems (Nuseibeh, Easterbrook, and Russo 2000).

Of the two IS development approaches looked at, one has been labeled the "project based" approach to Information Systems Development in the literature (Avgerou and Conford 1998; Avison and Fitzgerald 2003). Information Systems are predominantly developed from a project perspective (Paul 1994; Galal and Paul 1999, Avgerou and Conford 1998). This project-based approach would tend to view the output (in this case the Information System) as an asset to the organization and involve some variations around a structured process of development. The whole process is managed like a project or product. Because of the huge investment being undertaken the project is expected to deliver a system that would be managed like any other asset as a whole.

The second approach analyzed views an Information Systems development as a collection of different computer systems being brought together within an organizational framework for a specific purpose or to meet a particular objective. In this sense the Information System can be viewed as individual consumables that have been brought together. Working from an organizations stated objectives a requirements need based analysis is identified that would describe particular organizational needs based on their stated objectives. Computer systems that can meet these needs are identified. Once these computer systems are identified they can be introduced and modified to fit in with the organizational system. If another need is determined to meet the organizations objectives then the process is repeated. This mode of Information Systems development will work best in an area where there are common standards that would enable the seamless integration of the various computer systems. These computer systems can be likened to consumables in much the same way as computer parts are consumables of a personal computer. These consumables are then introduced and adapted as and when needed by the organization for its specific needs i.e. if you run out of memory you can add more memory to you personal computer without having to change it.

Although the two approaches differ we do not seek to argue that one is better than the other but only highlight the benefits in considering another approach.

ASSET OR CONSUMABLE

This paper argues that an organization's view of its IS network would have an impact on how new Systems would be implemented and used within it. Using a more modular approach as proposed by the "Consumable" view of an IS would give an organization more flexibility in its adoption and implementation of an Information System. Some of the benefits that would be presented by such a system include:

- Ability to adapt Information System without incurring a huge re engineering cost as the new functionality is gained by adding another Computer System
- Once a need is redundant in business terms the Computer System or "consumable" can easily be removed without a great effect on any of the other Computer Systems within the IS.
- Such a system can more easily adapt to changing business requirements as brought about by a change in the Organizations objectives

Problems associated with such a system would include:

- Integration Issues – possible problems with integrating Computer Systems from different suppliers
- Higher maintenance costs as there could be more divergent Computer Systems to support within the organization

In attempting to create an Information Systems that is Sustainable in terms of its performance and its life span it would be important to address the problems and maximize the benefits of Information Systems developed in this way. The "Key Argument" of this paper can be summed up in the following sentence.

"Would an Information System benefit from a loose design that allows parts of it to be changed or new parts added without affecting its performance in a negative way? Alternatively would a more structured design be better for the system (i.e. project based approach)?"

INTELLIGENT TRANSPORT SYSTEMS

Intelligent Transport Systems (ITS) are traffic systems designed and developed to perform more than just an automated traffic function such as control traffic systems. ITS actually involves a more innovative use of other dynamic elements that affect urban and rural traffic (Cheese and Radia 2000; Cartwright, Radia, Thancanamootoo and Tilley 2002). Building on the

case for Intelligent Transport Systems in traffic management, traffic systems in the United Kingdom have developed from systems designed to just control the flow of traffic in urban cities (Tate and Bell 2002). They are now being used as tools to manage the entire highway network including aspects of travel such as car parking (Cheese and Radia 2000). They are also now used to effect policy objectives. This has arisen partly due to an initiative from the Department of Transport in the United Kingdom (UK) called Urban Traffic Management and Control (UTMC). UTMC has been driven by a standards body made up of stakeholders in the Traffic Industry in the UK (Cartwright et al 2002). This body is charged with the responsibility for defining common interfaces and protocols for various ITS's.

At the heart of the UTMC protocol sits a common database that acts as the central hub for the Information System. The various Computer Systems pass data to the common database and can also access data from the common database. This forms a key part of the architecture that enables integration in all UTMC compliant Systems.

CASE STUDY (LIMITED BY CONFERENCE WORD RESTRICTIONS E-MAIL 2ND AUTHOR FOR FULL CASE)

One of the local authorities in the South East of England has chosen to adopt the principles of UTMC within their county traffic management systems. They are building a Network Management and Information Centre through which they plan to introduce various UTMC complaint systems. While implementing new systems the authority are keen to utilize their vast array of legacy systems they have invested in already. The reason behind the creation of a Network Management and Information Centre is primarily to expand the responsibilities of the traffic Signals team from one of maintaining the signals and equipment on a network to one of managing the entire network and impacting on the public's choice of mode of travel within the county. To achieve this the deployment of several new transport Systems has been proposed. The new systems are to be part of a new bread of "Intelligent Transport Systems".

System	Description	Supplier
Urban Traffic and Control (UTC)	Controls signals in urban cities	Siemens
Real Time Passenger Information System (RTPI)	Provides Real Time Bus Information	ACIS
Remote Monitoring System RMS	Monitors Signals for faults	Siemens
RMS	Monitors inter city signals	Monitron
Car Park Management	Displays live Car park availability in cities	Dambach
Variable Message Signs - VMS	Displaying En-route information	New Supplier
Traffic Counters	Gather statistics on vehicles	Golden River
QMISS	Database with Motorway Info.	HA

Table 1. List of Transport Systems

Table 1 lists various transport systems that have specific functions and capabilities. By deciding to adopt UTMC principles within the County's transport management the authority have been able to integrate these systems via the UTMC common database. This has led to an integrated view of the counties transport network and increased their Network management abilities. Their legacy systems such as the UTC and the RMS have been integrated with newer systems such as the VMS, RTPI and Traffic Counters. Information is crucial in any Network Management Function as whatever strategies adopted by the centre to tackle arising traffic situations have to be based on a "total picture" in order to have the desired effect (Cartwright et al 2002; Tate and Bell 2002).

THE PATH TO SUSTAINABILITY

Drawing parallels with the Case Study the local authority has inadvertently stumbled on a path to developing a Sustainable Information System to support their Organizational goals and objectives. There is evidence that our key argument regarding an Organizations view of its Information System network has been addressed. The local authority has taken the second approach and viewed its Information System Network for their new Centre as a collection of different Transport Systems "glued" together by a common database. This has given it the ability to add new systems to achieve specific objectives in the future. It also enables the Organization to decommission systems without affecting the whole Business function.

Certain factors have enabled this to occur. These are listed below:

- Adoption of Common and Open Standards (UTMC principles)
- Use of a Common Database
- Use of Transportation Systems to meet particular functions

By adopting the UTMC standards the Local Government Authority have committed all their system suppliers to a common standard and increased the potential for systems integration. Through the common database they now have a common interface to all their operational systems through which they can share information and data. Finally they use Transport Systems to meet particular operational objectives and because these are treated as "consumables" the systems can be swapped with modern systems utilizing the latest technology with added functionality without compromising the Information Systems network architecture that exists.

CONCLUSION

This paper has illustrated the opportunities presented by viewing Information Systems as a group of consumables. Although this area of research is still ongoing it gives a possible alternative to the traditional project based approach taken in the development of Information Systems. By utilizing the "Consumable view of an Information System" the local authority in the case study can be said to have created the environment for the growth and management of their Information Systems network. New Transport Systems can be introduced to meet particular objectives while still giving the Network Management and Information Centre the integrated view of all transport variables they need to carry out their function. Indeed these transport Systems can be viewed as the Computer Systems that are added to the overall Information Systems network to meet the organizations need. New systems can now be added when there is a new objective without compromising what already exists. An added advantage is the reduced cost involved of introducing the new System to the integrated Network Management and Information Centre System. Overall this has given the local authority what can be said to be a Sustainable Information System for the transportation needs in terms of the operational effectiveness of this system in the long term.

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